Health Care Utilization Patterns and Costs for Patients With Hidradenitis Suppurativa

Joslyn S. Kirby, MD; Jeffery J. Miller, MD, MBA; David R. Adams, MD, PharmD; Douglas Leslie, PhD

**IMPORTANCE** Hidradenitis suppurativa (HS) is a chronic cutaneous disease with acutely painful flares that require appropriate and timely treatment.

**OBJECTIVE** To assess how individuals with HS utilize medical care, especially emergency department (ED) care, a high-cost setting, and to describe the health care costs for this group.

**DESIGN, SETTING, AND PARTICIPANTS** Cohort cost-identification study of 150,493 individuals with claims from the MarketScan medical claims database. Patients with claims for HS and psoriasis (16,736 and 110,266, respectively) and a control group with neither condition (23,491) during the study period, January 2008 to December 2010, were included.

**EXPOSURES** An HS cohort was formed from all the patients who had 2 or more claims for HS (International Classification of Diseases, Ninth Revision [ICD-9] code 705.83) during the 3-year period. A psoriasis cohort was used as a comparison group, since it is another chronic inflammatory condition with prominent skin findings. This group included randomly selected patients who had 2 or more claims for psoriasis (ICD-9 code 696.1) during the 3-year period. A second control group included randomly selected patients who had no claims for either condition during the 3-year period. From these cohorts only patients that were continuously enrolled for the 3-year period were included.

**MAIN OUTCOMES AND MEASURES** Health care utilization measures including inpatient length of stay, emergency department and outpatient visits, and number of days supplied of prescription medication were investigated. Cost variables were also investigated and included inpatient, outpatient, emergency department, prescription drug, and total all-cause health care expenditures, which were adjusted for inflation and reported in 2010 US dollars.

**RESULTS** The largest component of the total 3-year cost for the HS group was inpatient cost (37.4%). In contrast, for the psoriasis group this was drug costs (46.5%) and for the control group, inpatient costs (40.9%). The proportion of people who were hospitalized in the HS cohort (15.8%) was higher than the psoriasis (10.8%) or control (8.6%) groups (P < .001). The proportion of patients who used the ED over the 3-year period was higher in the HS cohort (27.1%) than the psoriasis (17.4%) or control groups (17.2%) (P < .001). Similarly, the mean (SD) 3-year ED cost for the HS group was $2002 ($6632) and was higher than both comparison groups (P < .001). After adjustment for age, sex, and comorbidities, ED utilization remained higher in the HS group compared with the control (P < .001) and psoriasis (P = .02) cohorts.

**CONCLUSIONS AND RELEVANCE** Hidradenitis suppurativa affects a younger, predominantly female population of patients. High-cost settings, such as ED and inpatient care, are used more frequently for patients with HS. Both patients and clinicians should be aware of this finding, and further research is needed to investigate the impact of health care utilization on patient outcomes.
T o control costs in health care delivery, there is interest and effort focused on understanding and improving value.1 Value, as defined from the patient perspective, is the cooperation of clinicians across all aspects and episodes of care.2–3 Value, as defined from the perspective of the health care system, is framed by the quality or number of health outcomes for the resources used or dollars spent. A first step to improving value in health care delivery is to identify a disease that lacks coordination of care, a defined outcome, and understanding of costs. In dermatology, hidradenitis suppurativa (HS) is a chronic skin condition that anecdotally does not deliver on value, as defined by both the patient and health care system. Hidradenitis suppurativa, or acne inversa, results in inflammation and scarring of combinations of areas that often include the axillae, breasts, abdomen, inguinal creases, perineum, and perianal skin. The prevalence of HS, similar to that of psoriasis, is estimated to be 0.5% to 4% with a peak at ages 18 to 44 years.4–5 Medical and surgical treatments are moderately and inconsistently effective, and recurrence is common.6–8 Patients develop intermittent flares with acutely painful nodules and/or abscesses, which contribute to HS being underdiagnosed or misdiagnosed as “boils” or infection by nondermatologists.9,10 The acuity of flares and frequent diagnostic delay that patients experience may contribute to differences in health care utilization.

The objective of this study was to assess how individuals with HS utilize medical care, especially emergency department (ED) care and inpatient care, both high-cost settings. The secondary objective is to describe the all-cause costs for a cohort of people with HS. With this information, opportunities to improve the value of health care delivery for patients with HS can be investigated.

Methods

The Milton S. Hershey Medical Center institutional review board considered the study exempt. A retrospective cohort method was used to perform a cost-identification study that would compare the health care utilization and costs for patients with HS. To derive additional meaning, the HS group was compared not only with a control group without HS but also with a group with psoriasis because both are chronic, inflammatory conditions with intermittent flares, and both patient populations have higher rates of obesity, tobacco use, and depression.11–13

It was expected that patients with HS or psoriasis would have higher health care utilization and cost measures than the control group. Therefore, the control group was selected with a 1:1 ratio because this would likely be sufficient to demonstrate statistically significant differences. In contrast, it was hypothesized that both the HS and psoriasis groups would have higher rates of health care utilization and cost, so a larger ratio, 3:1, would be used in order to detect statistically significant differences.

Data Source and Variables

A retrospective analysis of the Truven Health MarketScan Commercial Claims and Encounters Database (Truven Health Analytics) was performed. The MarketScan database contains health insurance claims that are voluntarily submitted by approximately 100 payers. Information for over 120 million insured individuals in the United States from geographically diverse locations is included, making the database representative of the commercially insured population in the United States. The database contains information pertaining to inpatient hospital stays, outpatient visits, and specialty pharmacy use (both retail and mail order). As a claims database, clinical outcomes are not included, and validation studies of the variables have not been performed. Both HS and psoriasis are chronic diseases with intermittent flares, so a 3-year study period was used (January 2008–December 2010).

The clinician associated with a claim was coded as either a dermatologist or nondermatologist, although the documentation of this variable is not consistent throughout the database. Patient comorbidities were determined based on the International Classification of Diseases, Ninth Revision (ICD-9), documentation on claims. Diabetes mellitus was defined as ICD-9 codes 250.00 to 250.99, cardiovascular disease as codes 401.00 to 449.99, tobacco use or abuse as codes 305.00 to 305.03 and 305.1, major depression as codes 296.20 to 296.36, and essential hypertension as codes 401.00, 401.10, and 401.90.

Health care utilization measures include the number of inpatient days, ED and outpatient visits, and number of days supplied of prescription medication. The cost variables included inpatient, outpatient, ED, prescription drug, and total all-cause health care expenditures. The perspective was that of the health care system because the costs included payments by the insurer and the patient. All-cause costs for the 3-year period were used and as such included the costs of all services received by an individual and were not disease specific. Patient costs or societal costs owing to reduced productivity (indirect costs) were not included. All of the cost amounts were adjusted for inflation based on the medical care component of the consumer price index reported by the US Bureau of Labor Statistics and are reported in 2010 US dollars.14

Study Population

From the approximately 120 million individuals in the MarketScan database, our study sample included 366 964 individuals with 2 or more claims with an ICD-9 code for HS (705.83) or psoriasis (696.1) at any time during the 3-year study period claim. The requirement for 2 or more claims was added because validation studies have not been performed on this data set. A similar study on a large claims database demonstrated that the rate of HS was similar to that seen in cohort studies.15 A second control group of individuals without claims for either condition was also included (Figure 1). The groups were limited to individuals who were continuously enrolled in a participating health care plan for the entire 3-year study period (January 2008–December 2010), which resulted in a deviation from the original ratios (3:1 for psoriasis, 1:1 for controls). The claims for these patients were used to contribute information about prescription, inpatient, ED, or outpatient utilization. Co-morbid conditions for these patients were identified using ICD-9 codes and included hypertension, diabetes mellitus, major depression, cardiovascular disease, and tobacco abuse.
Figure 1. Derivation of the Study Population From the MarketScan Claims Database

170,000,000 Individuals in MarketScan database

366,964 Individuals with HS, psoriasis, or control with claims during 2008 to 2010

154,910 Individuals with HS, psoriasis, or control and continuous enrollment

17,228 Individuals with HS claim

114,304 Individuals with psoriasis claim

23,491 Individuals without claims for either condition (controls)

16,736 Individuals

110,266 Individuals

All individuals with a claim for HS (ICD-9 code 705.83) in 2008 to 2010 were selected. Individuals with a claim for psoriasis (ICD-9 code 696) were selected with a 3:1 ratio. Individuals with any medical claim but no claims for either disease were selected as controls with a 1:1 ratio to the HS claim population.

Selection of patients with hidradenitis suppurativa (HS) or psoriasis, or the control population with neither condition.

Statistical Analysis

Descriptive statistics were used to describe the age and sex distributions of the cohorts. The utilization and cost variables included inpatient, outpatient, ED, pharmacy, and total all-cause health care expenditures (which is the sum of the all-cause costs for each of the component measures), as well as the number of outpatient physician and ED visits, inpatient length of stay (LOS) (days), and days of prescription medication supplied. Given the skewed nature of health care utilization and cost data, the mean (SD), median, and 25th and 75th percentiles of the distribution were calculated for the service use and cost variables.

Differences in demographic characteristics among the 3 groups were explored. The Kruskal-Wallis test was used to detect differences among the 3 groups in the percentage of females and to compare median values for continuous variables. The Mantel-Haenszel test for ordinal data was used to examine the differences in age groups (0-17, 18-34, 35-44, 45-54, or 55-64 years) by sex or disease category.

Cost data are often highly skewed, with very high costs generated by a small number of individuals. Thus, the comparison of mean costs between cohorts and the formulation of prediction models is challenging because some of the assumptions made by common parametric tests are not met. Therefore, mean costs rather than median costs are preferred, and in large data sets parametric tests of the mean can be robust.15-18 Comparisons of the continuous outcome variables, including various types of costs and utilization, were made among the 3 groups using the analysis of variance test with a Tukey correction for multiple comparisons. Multivariate analyses of costs were performed using a generalized linear model with a log link and γ distribution. The variables in the multivariate analysis included sex, disease cohort as a single categorical variable, age, hypertension, diabetes mellitus, major depression, and tobacco use. Stata statistical software (version 13; StataCorp LP) was used to perform multivariate analyses of costs and utilization. We used SAS statistical software (version 9.3; SAS Institute Inc) for all other analyses. All statistical tests were 2-sided, and P<.05 was considered statistically significant.

Results

The study included data from 150,493 people who were continuously enrolled for all 3 years of the study period (Figure 1). Most of the population (54.7%) was male with a mean (SD) age of 42.3 (15.3) years. The HS and psoriasis cohorts were composed of 16,736 people and 110,266 people with 2 or more claims, respectively. The control cohort included 23,491 people without a claim for either condition. The mean age of the HS cohort was younger than the psoriasis cohort and slightly older than the control group, and these differences were all statistically significant (Table 1). The proportion of females in the HS cohort was higher (72.8%) than in the psoriasis cohort (52.4%) and the control cohort (53.0%) (Table 1). Women had higher costs for all cost types except for drug cost (P<.001). About 8% of the patients (12,204 of 150,493) were evaluated by a dermatologist at least once during the 3-year period. Approximately 3.8% of the patients in the HS cohort (638 of 16,736) had a documented encounter with a dermatologist. This rate was statistically significantly different from the proportions in the population with psoriasis (9.8% [10,908 of 110,266]) and the control population (2.5% [586 of 23,491]) (P<.001).

The largest component of the total 3-year cost for the HS and control groups was inpatient cost (37.4% and 40.9%, respectively) (Figure 2). In contrast, the largest component of an-
The mean number of ED visits for the HS group was higher in the HS cohort than in the psoriasis or control groups (6.4 vs 5.6 days; *P* = .06). Mean inpatient costs for each group were similar for the patients who were hospitalized during the 3-year period, the cumulative days supplied for all medications was highest in the psoriasis group; how-

Table 1. Population Characteristics, Utilization Measures, and All-Cause Costs for the Hidradenitis Suppurativa (HS), Psoriasis, and Control Groups, January 2008 to December 2010

<table>
<thead>
<tr>
<th>Variable</th>
<th>HS Population (Group 1)</th>
<th>Psoriasis Population (Group 2)</th>
<th>Control Population (Group 3)</th>
<th><em>P</em> Value for Group Comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members, total No.</td>
<td>16 736</td>
<td>110 266</td>
<td>23 491</td>
<td></td>
</tr>
<tr>
<td>Age, mean (SD) (median), y</td>
<td>38.2 (13.9) (39)</td>
<td>44.4 (14.2) (48)</td>
<td>35.5 (18.4) (39)</td>
<td>&lt;.001 &lt;.001 &lt;.001</td>
</tr>
<tr>
<td>Sex, No. (%)</td>
<td>12 184 (72.8)</td>
<td>57 748 (52.4)</td>
<td>12 452 (53.0)</td>
<td>&lt;.001 &lt;.001 .28</td>
</tr>
<tr>
<td>Comorbidities, No. (%)</td>
<td>6.3 (11.3) (3 [1-6])</td>
<td>5.2 (8.8) (3 [1-5])</td>
<td>4.6 (8.4) (2 [1-5])</td>
<td>&lt;.001 &lt;.001 &lt;.001</td>
</tr>
<tr>
<td>Members with any ED claim, No. (%)</td>
<td>4542 (27.1)</td>
<td>19 197 (17.4)</td>
<td>4038 (17.2)</td>
<td>&lt;.001 &lt;.001 &gt;.99</td>
</tr>
<tr>
<td>ED costs, mean (SD) (median IQR), $</td>
<td>2 885 (1243-6580)</td>
<td>2 100 (1243-6580)</td>
<td>2 700 (1563-4053)</td>
<td>.553 .09 .64</td>
</tr>
<tr>
<td>ED costs, mean (SD) (median IQR), No.</td>
<td>6863 (15 250)</td>
<td>6267 (13 241)</td>
<td>4071 (10 682)</td>
<td>&lt;.001 &lt;.001 &lt;.001</td>
</tr>
<tr>
<td>Outpatient costs, mean (SD) (median IQR), $</td>
<td>39.6 (36.3) (28 [15-51])</td>
<td>24 (27.6) (15 [8-30])</td>
<td>&lt;.001 .23 &lt;.001</td>
<td></td>
</tr>
<tr>
<td>Inpatient hospitalization costs, mean (SD) (median IQR), $</td>
<td>51 496 (7847)</td>
<td>50 984 (332 060)</td>
<td>50 094 (322 134)</td>
<td>.99 &gt;.99 .99</td>
</tr>
<tr>
<td>Drug and pharmacy costs, mean (SD) (median IQR), $</td>
<td>1738 (2473)</td>
<td>1397 (2416)</td>
<td>1239 (2004)</td>
<td>&lt;.001 &lt;.001 &lt;.001</td>
</tr>
<tr>
<td>Total costs, mean (SD) (median IQR), $</td>
<td>19 663 (80 316)</td>
<td>21 912 (91 076)</td>
<td>11 631 (105 247)</td>
<td>&lt;.001 .02 &lt;.001</td>
</tr>
</tbody>
</table>

Abbreviations: ED, emergency department; IQR, interquartile range.
ever, the number of days for the HS cohort was significantly higher than for the control group (1738 vs 1239; \( P < .001 \)). Similarly, mean drug costs were highest for the psoriasis group ($10,334); however, the HS group had higher mean drug costs than the control group ($5048 vs $3460; \( P < .001 \)).

The 18- to 34-year-old or “young adult” group was the largest in the HS cohort and included 4887 patients (29.2%) (Table 2). This same age group comprised 14.6% of the psoriasis group (16,108) and 17.4% of the control group (4096). The largest component of the 3-year total cost for the HS young adult group was inpatient care (48.4%). Almost a quarter of those in the HS subgroup had an inpatient claim, and the LOS for this group was higher than for the psoriasis subgroup (\( P = .02 \)). Approximately 30% of young adults in the HS group had a claim for ED care during the 3-year period.

Sex, age, and associated comorbidities, such as tobacco use or diabetes mellitus, could be associated with costs. Therefore, a multivariate regression analysis was performed with utilization and cost variables as the dependent variables and cohort status (HS, psoriasis, or control), age, sex, and comorbidities as the independent variables. The marginal effect of the mean was obtained (Table 3); this described the difference in utilization or cost attributable to HS in comparison with the psoriasis or control groups after adjustment for the other independent variables listed herein. After controlling for age, sex, and comorbidities, the mean 3-year total cost for the HS group was higher than the cost for the control cohort (\( P < .001 \)) and lower than the cost for the psoriasis cohort (\( P < .001 \)). For inpatient care, the LOS for those in the HS cohort was longer than the LOS for the control group by an average of 0.6 (95% CI, 0.04-1.3; \( P = .04 \)); however, the LOS difference between the HS and psoriasis cohorts was not statistically significant. The inpatient costs seemed to be higher for the HS cohort; however, these differences were not statistically significant. The number of ED visits for the HS group was higher than the control or psoriasis groups by 1.1 (95% CI, 0.8-1.5; \( P < .001 \)) and 0.8 days (95% CI, 0.5-1.1; \( P = .02 \)), respectively. However, the differences in ED cost for the HS group compared with the psoriasis and control cohorts were not significant.

Figure 2. Total All-Cause Cost for the Hidradenitis Suppurativa (HS), Psoriasis, and Control Groups, January 2008 to December 2010

The totals are shown with the proportion contributed by inpatient care, outpatient care, and prescription utilization.

Table 2. Population Characteristics, Utilization Measures, and All-Cause Cost for the Young Adult* Subgroups of the Hidradenitis Suppurativa (HS), Psoriasis, and Control Cohorts, January 2008 to December 2010b

<table>
<thead>
<tr>
<th>Variable</th>
<th>HS Population (Group 1)</th>
<th>Psoriasis Population (Group 2)</th>
<th>Control population (Group 3)</th>
<th>( P ) Value for Group Comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No.</td>
<td>4887</td>
<td>16,108</td>
<td>4096</td>
<td></td>
</tr>
<tr>
<td>Age, y</td>
<td>26.7 (5.1)</td>
<td>27.7 (5.0)</td>
<td>26.5 (5.4)</td>
<td>0.004</td>
</tr>
<tr>
<td>Sex, No. (%)</td>
<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Female</td>
<td>3768 (77.1)</td>
<td>8890 (55.2)</td>
<td>2248 (54.9)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1119 (22.9)</td>
<td>7218 (44.8)</td>
<td>1848 (45.1)</td>
<td></td>
</tr>
<tr>
<td>Enrollees with an ED claim, No. (%)</td>
<td>1478 (30.2)</td>
<td>3052 (18.9)</td>
<td>737 (17.9)</td>
<td>0.001</td>
</tr>
<tr>
<td>ED costs, $</td>
<td>2118 (6398)</td>
<td>1777 (5488)</td>
<td>1996 (6987)</td>
<td>0.16</td>
</tr>
<tr>
<td>ED claims, No.</td>
<td>6.5 (12.6)</td>
<td>5.2 (8.7)</td>
<td>4.7 (6.3)</td>
<td>0.01</td>
</tr>
<tr>
<td>Enrollees with an outpatient claim, No. (%)</td>
<td>4878 (99.8)</td>
<td>15,993 (99.3)</td>
<td>3975 (97.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Outpatient costs, $</td>
<td>5299 (9105)</td>
<td>4146 (7802)</td>
<td>3257 (10,822)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Outpatient claims, No.</td>
<td>32.7 (32.0)</td>
<td>29.8 (30.0)</td>
<td>19.5 (24.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Inpatient hospitalization costs, $</td>
<td>47,664 (129,724)</td>
<td>36,125 (98,390)</td>
<td>64,758 (554,493)</td>
<td>0.38</td>
</tr>
<tr>
<td>Inpatient days, No.</td>
<td>5.3 (9.5)</td>
<td>4.3 (9.9)</td>
<td>4.9 (14.6)</td>
<td>0.71</td>
</tr>
<tr>
<td>Enrollees with a pharmacy claim, No. (%)</td>
<td>4381 (89.7)</td>
<td>14,447 (88.7)</td>
<td>3373 (82.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Drug and pharmacy costs, $</td>
<td>3826 (27,933)</td>
<td>7909 (36,097)</td>
<td>1972 (6630)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Drug and pharmacy days supplied, No.</td>
<td>1148 (1695)</td>
<td>1073 (1550)</td>
<td>785 (1491)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Total costs, $</td>
<td>17,407 (68,455)</td>
<td>16,723 (54,518)</td>
<td>13,399 (202,310)</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Abbreviation: ED, emergency department.

*Patients 18 to 34 years old.

bData are given as means (SDs) except where noted.
Research Original Investigation
wheremostcliniciansarenotfamiliarwiththediagnosisand
cess to clinicians are more likely to utilize the ED, a setting
patients with an urgent medical condition and with limited ac-
tional increase in the number of dermatology clinicians.24 Pa-
careandinadequatesupplyeventhoughtherehasbeenana-
direct and indirect costs.1,21

for patients with HS to receive similar or improved outcomes
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received ED care. More study is needed to investigate the
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easeactivitybutalsoofhowpatientsreceivecarethroughout

discussion

Multiple reports show that higher health care costs do not correlate with improved outcomes.1,19,20 To address the rising cost of health care delivery, "value" is an increasingly important principle in health care because it incorporates both outcome and cost.2,3 One of the many drivers of increased health care spending is the use of high-cost settings, such as inpatient and ED care, for conditions amenable to outpatient treatment. This investigation demonstrates that high-cost settings, such as the ED and inpatient care, are used more frequently for patients with HS. Inpatient cost was the largest proportion of overall cost for the entire HS cohort, and 15.8% of patients with HS were hospitalized in the 3-year period. In addition 27.1% of the HS cohort had a claim for ED care and this proportion was even higher, 30.2%, for the young adult subgroup. While the adjusted inpatient and ED costs (Table 3) for the HS group were not significantly different, additional study is needed to determine if a difference exists and, if so, to determine the reasons and to make interventions. Hidradenitis suppurativa is a chronic disease that can be difficult to diagnose and treat and is characterized by flares that are acute and painful,7,29 so for some it may not be surprising that the HS cohort had a higher proportion of patients who received ED care. More study is needed to investigate the value of inpatient care and ED care for HS; it may be possible for patients with HS to receive similar or improved outcomes in an outpatient setting, which is associated with reduced direct and indirect costs.1,21

There is limited research to describe the supply and demand issues for acute dermatologic care, such as during an HS flare. The average appointment wait time for new or existing patients is close to or in excess of 1 month and even up to 3 months.22,23 This reflects an unmet demand for dermatologic care and inadequate supply even though there has been a national increase in the number of dermatology clinicians.24 Patients with an urgent medical condition and with limited access to clinicians are more likely to utilize the ED, a setting where most clinicians are not familiar with the diagnosis and treatment of HS.25,26 Nondermatologist clinicians may also benefit from educational interventions. Nondermatologist clinicians tend to have a lower diagnostic accuracy for skin conditions than dermatologists; however, the diagnostic accuracy for HS is not well described.27-30 Educational interventions may facilitate recognition of HS by nondermatologist clinicians in the ED and generalist settings and thereby improve the efficiency and value of care. Educational interventions for ED clinicians have been successful for neurological and psychological conditions.31,32

The largest proportion of total cost for the psoriasis cohort was for prescription drug cost. Several medications, including the tumor necrosis factor inhibitors, are US Food and Drug Administration–approved for psoriasis and have dramatically changed the way it is treated and its impact on patients’ quality of life.33-38 The use of these medications may explain the higher drug costs for the psoriasis group. Tumor necrosis factor inhibitors have been studied for the treatment of HS but, like many HS therapies, have not proven to be consistently or widely effective.7,29-42 This lack of highly effective medical treatments may also explain the differences in prescription vs ED and inpatient utilization for those with HS vs those with psoriasis.

This is an initial study of health care utilization and cost for patients with HS, and subsequent studies are needed to confirm and refine these findings in more detail. Future studies may focus on studying HS-specific health care costs and utilization. Others may try to understand the drivers, or features of a disease, population, or system that explain the costs. It is also important to study the impact of comorbid conditions, such as tobacco use, obesity, and metabolic syndrome, on HS outcomes and cost. The current study is constrained by the data available in a claims database. For example, important variables, such as disease activity, socioeconomic status, and race/ethnicity, are not available, and the validity of the ICD-9 codes is unknown. This study highlights the importance of longitudinal HS cohorts and the study not only of disease activity but also of how patients receive care throughout the health care system. By expanding the perspective even more broadly, research can start to consider not only the direct costs to the entire health care system but also the indirect costs owing to disease impact on the ability of the patient (and potentially support person) to work, and this would address the indirect cost of the disease.21 This study discussed the direct cost of HS, and the indirect costs of HS for a patient are not well described and may be considerable.

The strengths and weaknesses of this study should be considered along with the results. As with many databases, the MarketScan database is based on a large convenience sample and may contain biases or fail to generalize well to other popu-

Table 3. Age-, Sex-, and Comorbidity-Adjusted Differences in Mean Total Inpatient and Emergency Department (ED) Utilization Measures and Costs Due to Hidradenitis Suppurativa (HS) Compared With the Psoriasis Group and Control Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Marginal Effect of the Mean for HS Group vs Control</th>
<th>Marginal Difference for HS Group vs Psoriasis Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Difference, Mean (95% CI)</td>
<td>P Value</td>
</tr>
<tr>
<td>Total 3-year cost, $</td>
<td>6783 (5481 to 8084)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Inpatient length of stay, d</td>
<td>0.6 (0.04 to 1.3)</td>
<td>.04</td>
</tr>
<tr>
<td>Inpatient costs, $</td>
<td>5192 (−4745 to 15 129)</td>
<td>.31</td>
</tr>
<tr>
<td>ED visits, No.</td>
<td>1.1 (0.8 to 1.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>ED costs, $</td>
<td>207 (−56 to 471)</td>
<td>.12</td>
</tr>
</tbody>
</table>

Marginal Difference for HS Group vs Control

* Multivariate analyses included age as a continuous variable, sex, and comorbidities as binary variables, and cohort status as a categorical variable.
ations. The data come mostly from large employers and may not be representative of Medicare and Medicaid patients, the uninsured, or populations outside the United States. The database does not include measures of disease severity, and individuals with disease in remission may not have been included. In an attempt to decrease this latter error, the study included data for 3 years. Patients with HS were identified by claims with the HS-specific ICD-9 code, and this may not capture the entire HS population and may favor those with more severe disease. In this instance, the overall costs for the HS population would be underestimated, and costs per individual would be overestimated. The costs described in this study were all-cause costs and were not disease specific. Potential confounding factors, such as tobacco use and/or abuse, were not investigated in this pilot investigation. Subsequent studies would benefit from incorporating and defining the influence of additional patient characteristics such as socioeconomic status as well as characteristics of the clinician(s) and health care system.

Conclusions

There are opportunities to improve the value equation of care for patients with HS. This study demonstrated that the patients with HS used inpatient resources and the ED more frequently, but additional research on HS-specific utilization and cost is needed. Similar to stroke management, HS educational interventions for both patients and the nondermatologists should be investigated as an intervention to reduce unnecessary high-cost setting care. Defining outcome measures that are meaningful to patients that can be applied to future investigations would also improve the value of health care experienced by patients with HS.

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REFERENCES
10. van der Zee HH, Preus EP. Preliminary findings suggest hidradenitis suppurativa may be due to defective follicular support. Br J Dermatol. 2013;168(5):926-927.


